a thermal diffuser comprising a frame integrated with a case of an electronic component which is subjected to heat exchange with an exterior; and a plurality of protrusions being arranged in a web form with spacing on an inner wall of said frame in which a heat medium is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member integrally formed on an outer wall of said thermal diffuser, for radiating heat to the exterior, the heat being transferred via said thermal diffuser, and wherein

said frame has such a thermal resistance as to allow heat exchange between the exterior and the channel.

REMARKS

This is in response to the Office Action dated October 28, 2002 in which the Examiner:

(a) objected to the language of the specification;

(b) rejected the language in claims 1-42 under § 112;

(c) rejected claims 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 25, 26, 28, 29, 31, 32, 34, 35 as anticipated by Romero (U.S. Patent No. 5,915,463);

(d) rejected claims 3, 6, 9, 12, 15, 18, 21, 24, 30, 33 and 36 as anticipated by Snyder (U.S. Patent No. 6,418,019);

(e) rejected claims 37, 38 and 41 as anticipated by DiGiacomo (U.S. Patent No. 6,085,831);

(f) rejected claims 39 and 42 as anticipated by Snyder; and

(g) rejected claims 19,20, 22 and 23 as obvious over Romero in view of DiGiacomo..

Based on the above amendments and following remarks, the application is deemed to be in condition for allowance and action toward that end is respectfully requested.

I. THE OBJECTION TO THE SPECIFICATION SHOULD BE WITHDRAWN

The Examiner has objected to certain language in the specification. The specification has been reviewed and no significant errors were noted. For instance, on page 1, line 7, "in an electronic equipment" would have been better stated to be --in electronic equipment--. However, it was felt that changes such as these were too minor for the mass copying of paragraphs and could lead to more errors. Accordingly, it is earnestly submitted that the body of the specification need not be changed. If the Examiner however has specific examples in mind, applicants will certainly conform to the Examiner's wishes. It is further possible however, that the Examiner found the claim language to be quite confusing, which applicant acknowledges and has made the appropriate changes by amending every claim. Accordingly, the objection to the specification should be withdrawn.

II. THE §112 REJECTION OF THE CLAIMS SHOULD BE WITHDRAWN

The claims have been rejected under 35 U.S.C. §112. As each and every claim has been amended and any confusing language corrected, the §112 rejection of the claims should be withdrawn.

III. THE REJECTION IN VIEW OF THE REFERENCES SHOULD BE WITHDRAWN

A. ROMERO IS NOT CONFIGURED AS A HEAT PIPE

The Examiner rejected Claims 1, 2, 4, 5, 7, 8, 10, 11, 13, 14, 16, 17, 25, 26, 28, 29, 31, 32, 34, and 35 as being anticipated by Romero et al.. However as demonstrated herein, this is not so and the objection herein should be withdrawn.

First, the configuration of the present invention and Romero are different from each other. Romero et al. is not configured as a type of a "heat pipe" as is the present invention and as explicitly recited in independent claims 1, 2, 3, 37, 38, 39, 40, 41 and 42.

B. ROMERO DOES NOT HAVE THE INVENTION'S EMBOSSING OR TIGHT THERMAL COUPLING WITH THE HEAT SOURCE

Romero et al. also does not have any embossing (i.e. enabling capillaries to perform thermal diffusion and heat radiation via heat medium, disregarding the direction of gravity) made in the invention.

The present invention, in Claims 1 and 2 is configured as a type of a "heat pipe", and is embossed in the above-mentioned way. By embossing this way, a tight thermal coupling with the heat source is achieved together with achieving the physical and mechanical strength in the invention. These effects cannot be achieved from Romero et al., thus making the present invention different from Romero et al.

C. SNYDER DOES NOT HAVE AN INJECTION PATH PROVIDED TO INJECT THE COOLING FLUID INTO THE FRAME AND EACH OF THE OF PROJECTIONS AND ARE FORMED ON ONLY ONE OF THE FACES OF BASE PLATES

The Examiner rejected Claims 3, 6, 9, 12, 15, 18, 21, 24, 30, 33, 36 39 AND 42 as being anticipated by Snyder et al. However, the configuration of the present invention and Snyder et al. are different from each other.

Snyder et al. does not have "an injection path provided to inject the cooling fluid into the frame" as does the present invention. Moreover, in Snyder et al., each of the of projections 38 and 30 are formed on only one of the faces of base plates 37 and 29, and projections 41 are formed along the four cooling fluid passageways 27. However, the technical and physical significance of the form, size, and position of each of these projections are not clearly spelled out in Snyder et al. (These projections seem to be the material used in forming passageways in which the cooling fluid is transferred between four condenser chambers 26 and evaporator chamber 25.) In a passageway as such, most of the heat generated by electronic device 22 are transmitted to the heat sink 23 by the cooling fluid which goes through the passageway, and temperature of the cooling fluid in the passageway is lower as it gets further from the evaporator chamber 25.

The present invention performs radiation of heat generated from an electric component in a very different from Romero. The heat is transmitted through the heat medium which transfers along channels in web form among the projections and not through an existing passageways as in Snyder et al. Also, the heat is radiated so that the deviation in the distribution of the surface temperature of the thermal diffuser is made as small as possible when the deviation from the form, size, position, and the external thermal environment.

Because of the differences in the configuration, the present invention and Snyder et al. have differences in their effects also. The present invention can maintain its mechanical strength by performing the above-mentioned embossing and enhance circulation of the heat medium by having capillary attraction, even when the invention is formed in shape of a board having a large area.

D. THE REJECTION BASED ON COMBINATION OF DIGIACOMO AND ROMERO SHOULD BE WITHDRAWN

1. The Radiation Efficiency Difference Compound in DiGiacomo

The Examiner has rejected Claims 37, 38, and 41 as being anticipated by DiGiacomo et al.

However, the differences in the configurations of the present invention and DiGiacomo et al. creates differences in the efficiency of radiation in DiGiacomo et al. and the present invention. The metal wick 50 in DiGiacomo et al. is positioned near the semiconductor chip 27 and has a mesh-like configuration. It also evaporates working liquid in parallel in each room according to the amount of heat generated, when the rooms are made by dividing the heat sink enclosure 53 with a plurality of cooling fins 51.

With this configuration, the exchange or the transmission of heat between the neighboring rooms seem to be done through only the cooling fin 51, and not directly through the working liquid. The rooms are formed in a specific direction from the metal wick 50 (semiconductor chip 27) in a radial pattern, and each of the rooms are formed so that it is larger as it gets further from the metal wick 50.

Therefore, heat will not be transmitted uniformly to the external fins 58 when the distribution of the amount of heat on the surface of semiconductor chip 27 is greatly deviated due to the way the semiconductor chip operates. This causes the efficiency of radiation in the system as a whole to lower, or, if not, it would be difficult to maintain the high efficiency compared to the invention in Claims 37, 38, and 41.

2. DiGiacomo Does Not Disclose, Teach or Otherwise Suggest Promoting Reflow of Heat Medium by Capillary Attraction or Maintaining Strength

Further, DiGiacomo et al. does not disclose either promoting reflow of heat medium by use of capillary attraction, or maintaining strength when the invention is formed in the shape of a large board. And since the configuration disclosed in DiGiacomo et al. is not in the shape of a large board, heat cannot be diffused on a large surface.

3. The Capillary Flow in DiGiacomo is Very Different

The Examiner rejected Claims 19, 20, 22, and 23 as being unpatentable over Romero et al. in view of DiGiacomo et al. As demonstrated herein, this is not so and this rejection also should be withdrawn. First, Romero et al. does not disclose the present invention as the Examiner asserts. (Please refer to the above response to the lack of novelty over Romero et al.)

Second, although the Examiner points out that DiGiacomo et al. discloses utilizing capillary flow (capillary attraction) as shown in the present invention, the capillary attraction referred to in the present invention differs from the same in DiGiacomo et al. The capillary flow in DiGiacomo et al. does not function in the room that heat is transferred from the working liquid to the cooling fin 57 (heat sink enclosure 53) by having the working liquid evaporate, as said above. The capillary flow in DiGiacomo et al. only functions in the range between the inside of

and the surface of the metal wick 50 positioned near the semiconductor chip 72.

In comparison, the capillary attraction in the present invention functions all through the passage where the heat to be radiated is transferred by the heat medium. This makes it so that heat conduction and the heat radiation are promoted all through the passage.

The Examiner also rejected Claims 3 and 27 as being unpatentable over DiGiacomo et al.

However, DiGiaicomo et al. does not disclose the present invention as the Examiner asserts. (Please refer to the above response to the lack of novelty over DiGiacomo et al.)

Therefore, Claims 3 and 27 should not be obvious over DiGiacomo et al.

Also please note that there are other effects that can be achieved by the present invention that is not disclosed in the cited references. They are as follows:

Page 5, lines 13-15:

"It is an object of the present invention to provide--- without cost." and

p. 6, lines 21- 24, "Moreover, it is yet another object of the present invention to ease--- the equipment and the system."

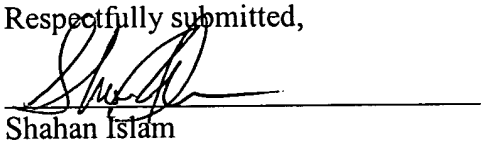
CONCLUSION

In view of the above, the application is deemed to be in condition for allowance and action to that end is respectfully requested.

Should the Examiner require or consider it advisable that the specification, claims an/or drawings be further amended or corrected in formal respects, in order to place the case in condition for final allowance, then it is respectfully requested that such amendment or correction be carried out by Examiner's Amendment and the case be passed to issue.

Alternatively, should the Examiner feel that a personal discussion might be helpful in advancing this case to allowance, the Examiner is invited to telephone the undersigned.

Respectfully submitted,



Shahan Islam
Registration No. 32,507

DATE: January 28, 2003

KMZ Rosenman
575 Madison Avenue
New York, NY 10022-2585
Tel. (212) 940-8564
Docket No. FUJX 19.423

APPENDIX – "MARKED-UP" FORM

IN THE CLAIMS

1. (amended) A thermal diffuser comprising:

a plate-like [shaped] structure [provided with] having a wall on [the fringing part] its fringe [and welded or bonded to], and being attached to a [the] case of an electronic component by means of welding or bonding with [via] the wall; and

a plurality of protrusions [provided] being arranged with spacing in a web form, the plurality of protrusions being mounted in a region which is surrounded [by] with said wall, said case, and said plate-like structure and [forming a channel in a mesh through] in which a heat medium is confined [in the region], the spacing among said protrusions forming a channel through which the heat medium [confined in the region] recirculates.

2. (amended) A thermal diffuser comprising:

a housing having an outer wall capable of being thermally coupled with the a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and

a plurality of protrusions [protrudingly provided] being arranged with spacing in a web form on [the] an inner wall of said housing [and forming a channel in a mesh through] in which a heat medium [confined inside said housing] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates, and wherein

said housing has such a thermal resistance [at such a value] as to allow the heat exchange [can be achieved] between the exterior and the channel.

3. (amended) A thermal diffuser comprising:

a frame [formed integrally] integrated with [the] a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and

a plurality of protrusions [protrudingly provided] being arranged in a web form with spacing on [the] an inner wall of said frame [and forming a channel in a mesh through] in which a heat medium [confined inside said frame] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates, and wherein

said frame has such a thermal resistance [at such a value] as to allow the heat exchange [can be achieved] between the exterior and the channel.

4. (amended) The thermal diffuser according to claim 1, further comprising

a heat medium injection path formed [through] in said wall of said plate-like structure and used for injection of the heat medium [to] into the channel from the exterior.

5. (amended) The thermal diffuser according to claim 2, further comprising

a heat medium injection path formed [through] in said wall of said plate-like structure and used for injection of the heat medium [to] into the channel from the exterior.

6. (amended) The thermal diffuser according to claim 3, further comprising

a heat medium injection path formed [through] in said wall of said plate-like structure and used for injection of the heat medium [to] into the channel from the exterior.

7. (amended) The thermal diffuser according to claim 1, wherein

[the channel is formed thickly] said plurality of protrusions being closely arranged in a region, the region being near a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

8. (amended) The thermal diffuser according to claim 2, wherein

[the channel is formed thickly] said plurality of protrusions being closely arranged in a region, the region being near a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

9. (amended) The thermal diffuser according to claim 3, wherein

[the channel is formed thickly] said plurality of protrusions being closely arranged in a region, the region being near a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

10. (amended) The thermal diffuser according to claim 1, wherein

[the channel is formed] said plurality of protrusions being arranged with uniform density in a region, the region being distant from a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

11. (amended) The thermal diffuser according to claim 2, wherein

[the channel is formed] said plurality of protrusions being arranged with uniform density in a region, the region being distant from a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

12. (amended) The thermal diffuser according to claim 3, wherein

[the channel is formed] said plurality of protrusions being arranged with uniform density in a region, the region being distant from a device or a circuit which is provided in the electronic component and is [to undergo] subjected to the heat exchange.

13. (amended) The thermal diffuser according to claim 1, wherein

top part(s) of all or a part of said plurality of protrusions has/have a shape and a size large enough to have [a] said channel [formed on the top part] pass therethrough.

14. (amended) The thermal diffuser according to claim 2, wherein

top part(s) of all or a part of said plurality of protrusions has/have a shape and a size large enough to have [a] said channel [formed on the top part] pass therethrough.

15. (amended) The thermal diffuser according to claim 3, wherein

top part(s) of all or a part of said plurality of protrusions has/have a shape and a size large enough to have [a] said channel [formed on the top part] pass therethrough.

16. (amended) The thermal diffuser according to claim 1, wherein

all or a part of said plurality of protrusions [is/are formed in] has/have a partly contracted pillar or wedge shape.

17. (amended) The thermal diffuser according to claim 2, wherein

all or a part of said plurality of protrusions [is/are formed in] has/have a partly contracted pillar or wedge shape.

18. (amended) The thermal diffuser according to claim 3, wherein

all or a part of said plurality of protrusions [is/are formed in] has/have a partly contracted pillar or wedge shape.

19. (amended) The thermal diffuser according to claim 1, wherein

[the ingredients, shapes and sizes of] said plurality of protrusions and/or said inner wall have a material, a shape, and a size such that [are determined to allow capillary attraction acting on] recirculation of the heat medium [in the channel to promote recirculation of the heat medium] is promoted by capillary attraction in the channel.

20. (amended) The thermal diffuser according to claim 2, wherein

[the ingredients, shapes and sizes of] said plurality of protrusions and/or said inner wall have a material, a shape, and a size such that [are determined to allow capillary attraction acting on] recirculation of the heat medium [in the channel to promote recirculation of the heat medium] is promoted by capillary attraction in the channel.

21. (amended) The thermal diffuser according to claim 3, wherein

[the ingredients, shapes and sizes of] said plurality of protrusions and/or said inner wall have a material, a shape, and a size such that [are determined to allow capillary attraction acting on] recirculation of the heat medium [in the channel to promote recirculation of the heat medium] is promoted by capillary attraction in the channel.

22. (amended) The thermal diffuser according to claim 1, further comprising

a medium [poured] inserted in all or a part of sections of the channel, for increasing capillary attraction [acting on] to the heat medium in the channel.

23. (amended) The thermal diffuser according to claim 2, further comprising

a medium [poured] inserted in all or a part of sections of the channel, for increasing capillary attraction [acting on] to the heat medium in the channel.

24. (amended) The thermal diffuser according to claim 3, further comprising

a medium [poured] inserted in all or a part of sections of the channel, for increasing capillary attraction [acting on] to the heat medium in the channel.

25. (amended) The thermal diffuser according to claim 1, wherein

all or a part of said plurality of protrusions has/have one of a hole [formed which is] and a member, the hole being used for joining and/or coupling the thermal diffuser [with] and said case [or a], the member being used for fastening the thermal diffuser in order to maintain thermal coupling with said case.

26. (amended) The thermal diffuser according to claim 2, wherein

all or a part of said plurality of protrusions has/have one of a hole [formed which is] and a member, the hole being used for joining and/or coupling the thermal diffuser [with] and said case [or a], the member being used for fastening the thermal diffuser in order to maintain thermal coupling with said case.

27. (amended) The thermal diffuser according to claim 3, wherein

all or a part of said plurality of protrusions has/have one of a hole [formed which is] and a member, the hole being used for joining and/or coupling the thermal diffuser [with] and said case [or a], the member being used for fastening the thermal diffuser in order to maintain thermal coupling with said case.

28. (amended) The thermal diffuser according to claim 1, further comprising

one of a member used for [joining and /or coupling the thermal diffuser with said case or] fastening the thermal diffuser in order to maintain thermal coupling with said case, and a member(s) integrated [integrally formed] with all or a part of said plurality of protrusions individually and used for joining and/or coupling the thermal diffuser and said case.

29. (amended) The thermal diffuser according to claim 2, further comprising

one of a member used for [joining and /or coupling the thermal diffuser with said case or] fastening the thermal diffuser in order to maintain thermal coupling with said case, and a member(s) integrated [integrally formed] with all or a part of said plurality of protrusions individually and used for joining and/or coupling the thermal diffuser and said case.

30. (amended) The thermal diffuser according to claim 3, further comprising

one of a member used for [joining and /or coupling the thermal diffuser with said case or] fastening the thermal diffuser in order to maintain thermal coupling with said case, and a member(s) integrated [integrally formed] with all or a part of said plurality of protrusions individually and used for joining and/or coupling the thermal diffuser and said case.

31. (amended) The thermal diffuser according to claim 1, wherein

a total amount of the heat medium is set [at] to such an amount [to allow] that the heat medium steadily recirculates in a part of the channel [being], the part being most closely thermally coupled with the electronic component.

32. (amended) The thermal diffuser according to claim 2, wherein

a total amount of the heat medium is set [at] to such an amount [to allow] that the heat medium steadily recirculates in a part of the channel [being], the part being most closely thermally coupled with the electronic component.

33. (amended) The thermal diffuser according to claim 3, wherein

a total amount of the heat medium is set [at] to such an amount [to allow] that the heat medium steadily recirculates in a part of the channel [being], the part being most closely thermally coupled with the electronic component.

34. (amended) The thermal diffuser according to claim 1, wherein

said plate-like structure has a shape and [an ingredient] a material such that the said plate-like structure has a desired degree of thermal coupling with the exterior or a specific member [becomes a desired value].

35. (amended) The thermal diffuser according to claim 2, wherein

said outer wall has a shape and [an ingredient] a material such that the said plate-like structure has a desired degree of thermal coupling with the exterior or a specific member [becomes a desired value].

36. (amended) The thermal diffuser according to claim 3, wherein

the outer wall of said frame has a shape and [an ingredient] a material such that the said plate-like structure has a desired degree of thermal coupling with the exterior or a specific member [becomes a desired value].

37. (amended) A radiator comprising:

a thermal diffuser comprising a plate-like [shaped] structure [provided with] having a wall on [the fringing part] its fringe [and welded or bonded to], and being attached to a [the] case of an electronic component by means of welding or bonding with the wall; and a plurality of protrusions [provided] being arranged with spacing in a web form, the plurality of protrusions being mounted in a region which is surrounded by with said wall, said case, and said plate-like structure and [forming a channel in a mesh through] in which a heat medium is confined [in the region], the spacing among said protrusions forming a channel through which the heat medium [confined in the region] recirculates; and

a radiating member thermally coupled with the an outer wall of said thermal diffuser, for radiating heat to an exterior, the heat being transferred via said thermal diffuser [to an exterior].

38. (amended) A radiator comprising:

a thermal diffuser comprising a housing having an outer wall capable of being thermally coupled with the a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and a plurality of protrusions [protrudingly provided] being arranged with spacing in a web form on [the] an inner wall of said housing [and forming a channel in a

mesh through] in which a heat medium [confined inside said housing] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member thermally coupled with [the] an outer wall of said thermal diffuser, for radiating heat to the exterior, the heat being transferred via said thermal diffuser [to an exterior], and wherein

said housing has such a thermal resistance [at such a value] as to allow the heat exchange [can be achieved] between the exterior and the channel.

39. (amended) A radiator comprising:

a thermal diffuser comprising a frame [formed integrally] integrated with [the] a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and a plurality of protrusions [protrudingly provided] being arranged in a web form with spacing on [the] an inner wall of said frame [and forming a channel in a mesh through] in which a heat medium [confined inside said frame] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member thermally coupled with [the] an outer wall of said thermal diffuser, for radiating heat to an exterior, the heat being transferred via said thermal diffuser [to an exterior], and wherein

said frame has such a thermal resistance [at such a value] as to allow the heat exchange [can be achieved] between the exterior and the channel.

40. (amended) A radiator comprising:

a thermal diffuser comprising a plate-like [shaped] structure provided with having a wall on the fringing part its fringe [and welded or bonded to] , and being attached to a [the] case of an electronic component by means of welding or bonding with the wall; and a plurality of protrusions [provided] being arranged with spacing in a web form, the plurality of protrusions being mounted in a region which is surrounded [by] with said wall, said case, and said plate-like structure and [forming a channel in a mesh through] in which a heat medium is confined [in the region], the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member integrally formed [with said thermal diffuser] on [the] an outer wall of said thermal diffuser, for radiating heat to an exterior, the heat being transferred via said thermal diffuser [to an exterior].

41. (amended) A radiator comprising:

a thermal diffuser comprising a housing having an outer wall capable of being thermally coupled with the a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and a plurality of protrusions [protrudingly provided] being arranged with spacing in a web form on [the] an inner wall of said housing [and forming a channel in a mesh through] in which a heat medium [confined inside said housing] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member integrally formed [with said thermal diffuser] on [the] an outer wall of said thermal diffuser, for radiating heat to the exterior, the heat being transferred via said thermal diffuser [to an exterior], and wherein

said housing has such a thermal resistance [at such a value that] as to allow heat exchange [can be achieved] between the exterior and the channel.

42. (amended) A radiator comprising:

a thermal diffuser comprising a frame [formed integrally] integrated with the a case of an electronic component which is [to undergo] subjected to heat exchange with an exterior; and a plurality of protrusions [protrudingly provided] being arranged in a web form with spacing on [the] an inner wall of said frame [and forming a channel in a mesh through] in which a heat medium [confined inside said frame] is confined, the spacing among said protrusions forming a channel through which the heat medium recirculates; and

a radiating member integrally formed [with said thermal diffuser] on [the] an outer wall of said thermal diffuser, for radiating heat to the exterior, the heat being transferred via said thermal diffuser [to an exterior], and wherein

said frame has such a thermal resistance [at such a value that] as to allow heat exchange [can be achieved] between the exterior and the channel.